REMARKS

Claims 1, 2 and 9-11, 14, 15, 18 and 19 remain pending for further prosecution in the present application. Applicant submits arguments for overcoming the rejections over the prior art of record and respectfully requests reconsideration. Accordingly, Applicant respectfully submits that the present application is in condition for allowance.

I. Claim Rejections - 35 USC §103(a)

A. In the non-final Office Action dated July 27, 2011, claims 1, 2, 9-11, 14, 15, 18 and 19 are rejected under 35 USC §103(a) as being obvious over U.S. Patent Application Publication No. 2003/0062261 A1 of Shindo.

It should be understood that the change in the "free energy" of a metal material upon introducing an arbitrary impurity element into an arbitrary metal material crystal lattice will always be a finite value (i.e., it will never be infinite). Thus, regardless of the type of impurity element in the metal material, it is thermodynamically impossible to reduce the concentration of the impurity element to zero (0).

With the above in mind and with respect to the cited '261 Shindo application publication, it is known that large amounts of Zr and O will always be contained in a non-purified Hf material, and it is also known that the physical-chemical property of Zr is similar to Hf and that it is difficult to separate and remove Zr and O from Hf.

For the above reasons, Applicant respectfully submits that it is an error to conclude "one skilled in the art would be informed that the lower limit of these ranges (content of Zr and O within an Hf composition) would be 0". (See this conclusion on page 8 of the Office Action.) Reconsideration of this point is requested. One of ordinary skill in the art would certainly not expect Zr and O within an Hf composition to be reducible to "0".

In addition, Applicant respectfully submits that Shindo '261 fails to disclose the reduction of Zr and O in a purified Hf material as required by the claims of the present application and, in addition, fails to teach the effect, result, or utility of such reduction. In contrast to the present invention, Shindo '261 provides teachings to one of ordinary skill in the art that the inclusion of a high concentration of Zr in a purified Hf material is harmless. For example, see Paragraph No. 0065 of Shindo '261. Accordingly, Applicants respectfully submit that Shindo fails to provide one of ordinary skill in the art with any motivation for reducing Zr to the extent required by the claims of the present application.

Further, Applicants respectfully submit that Shindo '261 lacks the requirements for establishing a prima facie case of obviousness. For reasons discussed below in greater detail, Applicant respectfully submits that Shindo '261 fails to show overlapping ranges of composition and the motivation for modifying the composition to the extent required by the claims of the present application.

The concentrations of Zr and O as impurities are reduced in the present invention for purposes of stabilizing the characteristics of a hafnium composition. This in turn yields a result of making the composition useful in electronic products. See: page 2, line 22, to page 3, line 4; page 4, lines 19-21; page 5, line 33, to page 6, line 2; and page 9, lines 4-9, of the present application, as filed.

An Hf composition capable of providing such a result is not taught nor expected from the disclosure of Shindo '261. Accordingly, Applicant respectfully submits that the composition required by the claims of the present application is not obvious from the teachings provided to one of ordinary skill in the art by the Shindo '261 reference.

More specifically, Shindo '261 discloses analytical values of Zr content of 3500 ppm and 2400 ppm and O content of 120 ppm. It is well known that the purity of a metal obtained from the same disclosed purification process will be of a similar purity level. If the lower limit of the analytical value is determined based on analysis of numerous purified samples, it is possible to assume that such lower limit will not vary greatly from the analytical values disclosed in the Examples, for instance of Shindo '261. Here, the Examples disclosed in the prior art reference are relevant for showing the lower limit that one of ordinary skill in the art would expect. A purification process has its limits and further reduction of impurities is not expected by one of ordinary skill in the art.

The purity level of the pure metal obtained by an arbitrary purification process depends on the purification process. The purification process disclosed in the present application clearly yields higher purification performance with respect to reducing impurity contents Zr and O in an Hf composition as compared to the process disclosed in Shindo '261. Thus, the concentrations of Zr and O in the Hf composition required by the claims of the present application are clearly lower in comparison to the composition disclosed in Shindo '261.

The upper limits of Zr and O in the Hf composition required by the claims in the present application are 1000 ppm and 40 ppm, respectively. The analytical values disclosed in Shindo '261 considerably exceed these upper limits. Thus, Applicants respectfully submit that the concentration ranges of Zr and O in the composition required by the claims of the present application are lower than the ranges of the composition disclosed by Shindo '261 and do not overlap. Accordingly, Applicant respectfully requests reconsideration of this rejection.

In addition, the ranges recited by the claims of the present application provide an unexpected result and are critical for providing the result.

The "residual resistance ratio" of a material is generally used as a reference for quantitatively representing the impurity content and processing strain concentration existing in a high purity metal. However, the residual resistance ratio is not a value that depends only on the type and/or concentration of trace amounts of impurity elements remaining in a high purity metal. For purposes of providing evidence of this fact, the publication titled "Tensile Test of Serially Poly-Crystallized Nb Wire" is submitted herewith by way of an Information Disclosure Statement. On the right column on page 106 of this publication, the following is described:

> "The residual resistance ratio ... takes on a greater value when there are fewer crystal defects and crystal grain boundaries."

Thus, the greater the residual resistance ratio means that there are fewer crystal defects (i.e., dislocation, holes, etc.). Accordingly, even if the purity is of a given level, this does not mean that the same level of residual resistance ratio will be obtained for a material (i.e., crystal defects must be taken into account).

The composition required of the claims of the present application is able to produce a thin film having a high residual resistance ratio. For example, see: page 3, lines 1-4; page 4, lines 19-21; page 5, line 33, to page 6, line 2; and page 9, lines 4-13, of the present application, as filed. This unexpected result is yielded at least in part to the reduction of crystal defects (processing strain). This is critical for the composition to meet the demands for use in depositing the composition as thin film electronic components.

With respect to this point, Shindo '261 fails to disclose or even suggest the residual resistance ratio of its composition. It should be understood that the high purity hafnium of the present invention is not simply an achievement of a higher purity in comparison to the hafnium composition of Shindo '261, it is also a composition that yields the unexpected results and

effects as follows: a composition having few crystal defects (processing strain) and that is possible to sufficiently meet the demands as a thin film electronic component material.

For all the above reasons, Applicant respectfully submits that the claims of the present application are patentable and are non-obvious relative to the teachings of Shindo '261. Accordingly, Applicant respectfully requests reconsideration and removal of the rejection.

B. In the on-final Office Action of July 27, 2011, claims 1, 2, 9, 10, 18 and 19 are rejected under 35 USC §103(a) as being obvious over ASM Handbook Volume 2, pp. 1093-1097.

The Examiner asserts that the ASM Handbook discloses that metals such as Hf, Th, V, Nb, Ta and Mo have been purified by a CVD method as with Ti, Zr and Cr. The Examiner also asserts that, from this vague disclosure, one of ordinary skill in the art can predict that the purity of Hf can be close to 99.999% when using the disclosed purification process.

Applicant acknowledges that the ASM Handbook teaches a CVD method that can be applied to Hf; however, the ASM Handbook clearly fails to disclose a purity level of Hf that can be achieved. The only evidence provided is by "Ref. 5" cited in the ASM Handbook discussed in Applicant's previous responses. The purity disclosed in Ref. 5 is significantly less than that required by the claims of the present application.

From an inspection of "Ref. 5" (of record in the present application), the purity of Hf subject to the iodide process is 98.92 to 99.22% and the oxygen content is 140 to 500ppm. These values are significantly different from that required by the claims of the present application and clearly do not "overlap" the requirements of the claims of the present application. Accordingly, Applicant respectfully submits that a *prima facie* case of obviousness has not been established.

For this reason, Applicant respectfully submits that one of ordinary skill in the art would not have expected the purity of an Hf composition to achieve a level close to 99.999% based on the method disclosed by the ASM Handbook as further evidenced by Ref. 5 cited in the ASM Handbook. Thus, Applicant respectfully submits that he have met his obligation of proving non-obviousness and that a prima facie case of obviousness cannot be established based on the ASM Handbook. The only evidence of the purity level of Hf achievable by the method disclosed by the ASM Handbook is directly and explicitly provided by Ref. 5.

Accordingly, for all the above reasons, Applicant respectfully submits that the ASM Handbook has been misinterpreted, that it fails to disclose a hafnium material "overlapping" with the requirements of the claims of the present application, and that a *prima facie* case of obviousness cannot be provided by the ASM Handbook. Applicant respectfully requests reconsideration and removal of the rejection.

II. Conclusion

In view of the above remarks, Applicant respectfully submits that the claim rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Response to our deposit account no. 08-3040.

Respectfully submitted,
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